LED LIGHTING UPDATE

With Thad and Chick Lanham

LED TECHNOLOGY…

Since 2010…

100 LUMENS PER WATT WAS THE HOLY GRAIL OF LED. LED DIODES HAVE NOW BEEN PRODUCED THAT ARE REACHING OVER 200 LUMENS PER WATT.

DIMMING WENT AS LOW AS 10% LIGHT OUTPUT. WE NOW ARE ABLE TO DIM TO LESS THAN 1%.

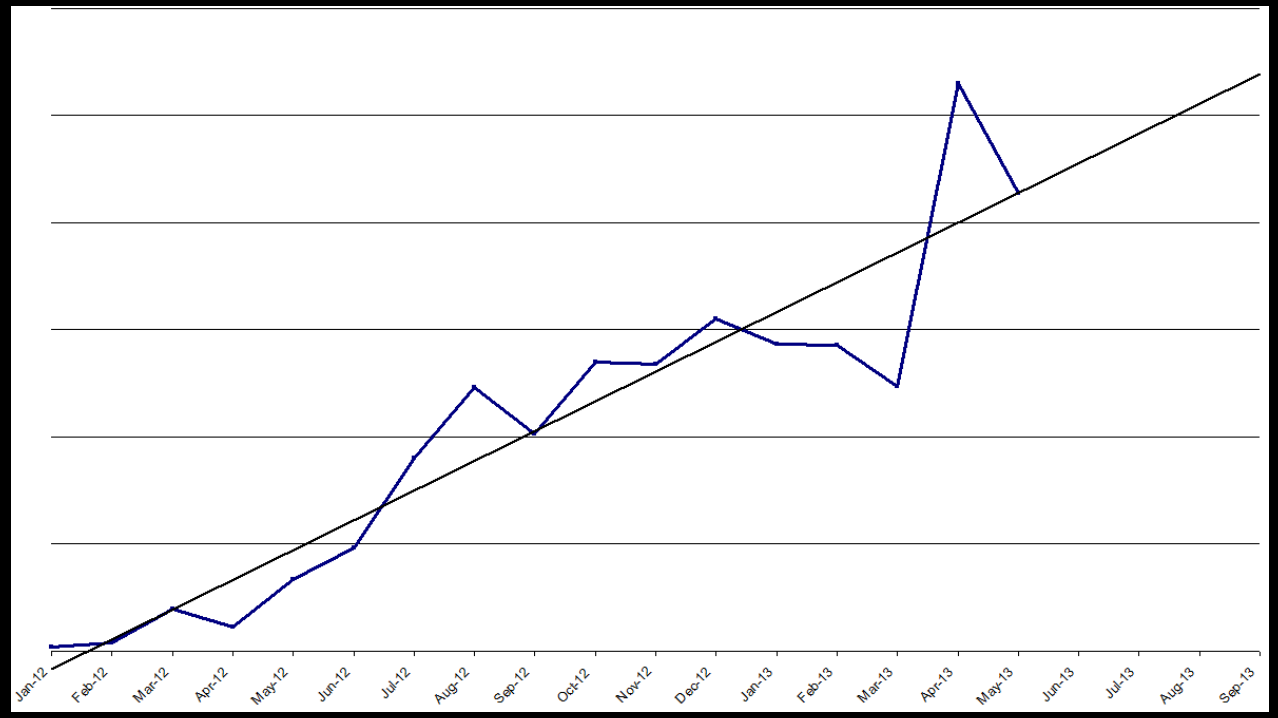
FIXTURES MAXED OUT AT 10,000 LUMENS. WE ARE NOW REACHING OVER 70,000 DELIVERED LUMENS IN CERTAIN FIXTURE TYPES.

COLOR WAS KIND OF WHITE. WE NOW HAVE ADJUSTABLE CRI.

CONTROLS EQUIPEMT AND STRATEGIES TO CONTROL THESE DIGITAL FIXTURES HAVE GROWN AS WELL.

DOE LIGHTING FACTS, CALIPER TESTING, DLC CERTIFICATION, ENERGY STAR, IES AND OTHERS HAVE PROVIDED STANDARDS FOR RELIABILITY AND PERFORMANCE.

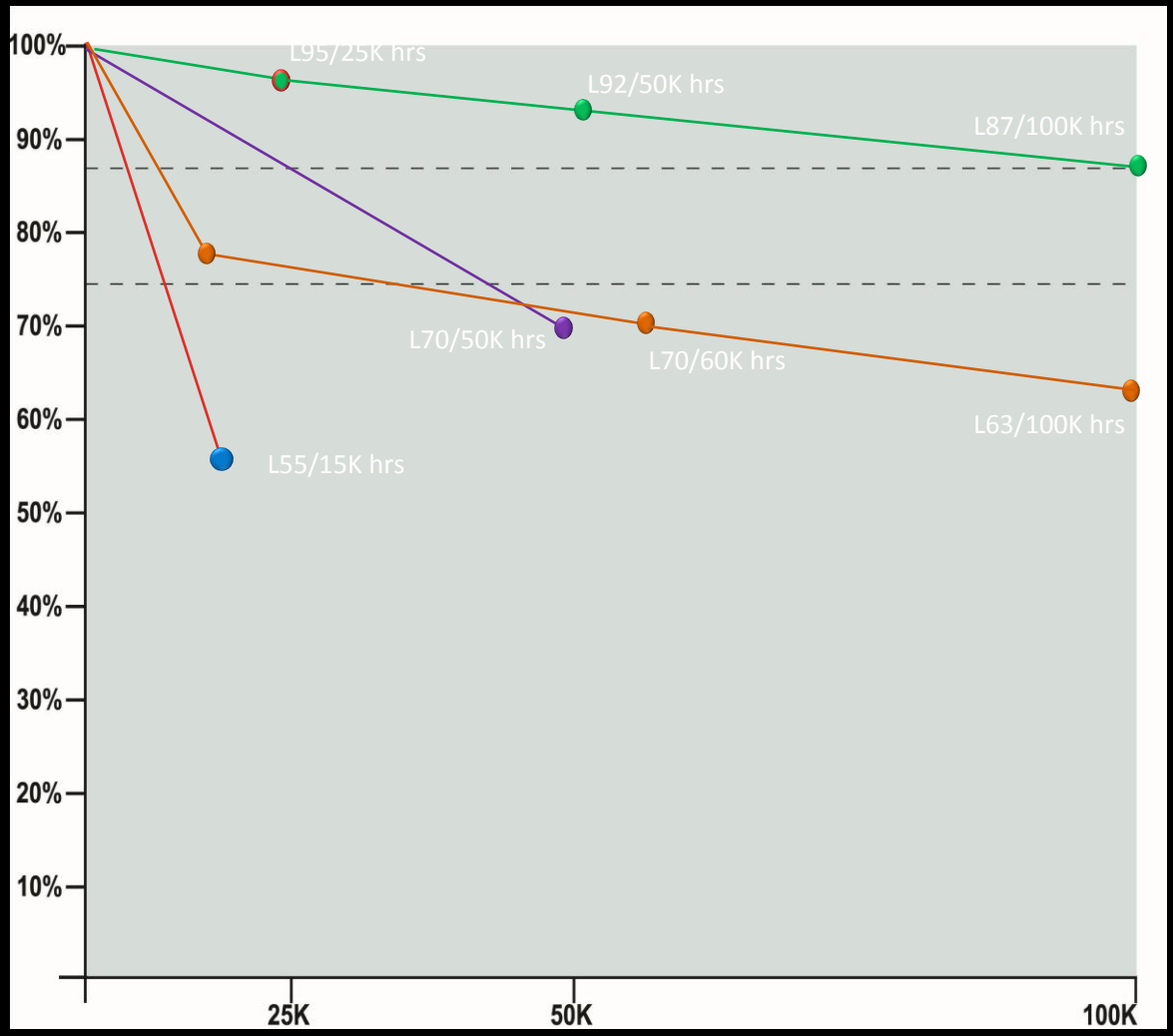
LED LIGHTING SALES



LED LIGHTING SALES HAVE INCREASED TO 35% OF TOTAL LIGHTING SALES. OUTDOOR IS OUTPACING THAT NUMBER AT OVER 40%. DOWNLIGHTING IS AT 47%. THE CONVERSION IS PROJECTED TO REACH 50% IN 2014, ONE YEAR AHEAD OF EARLIER PROJECTIONS .

100 LUMENS PER WATT WAS ASSUMED TO BE THE MAXIMUM. THE REALITY TODAY IS OVER 200 LUMENS PER WATT FOR AN LED DIODE.

Longevity



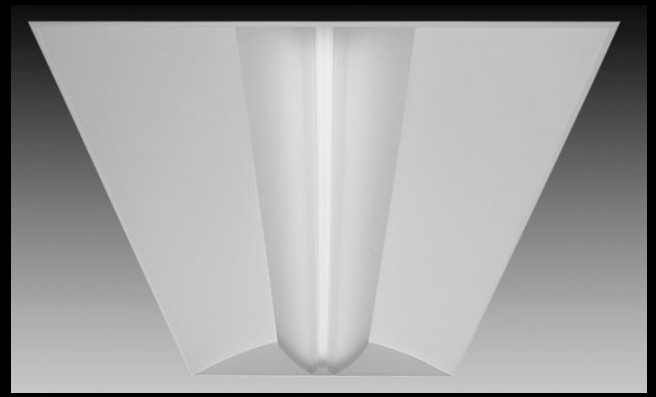
LEGEND
---- 2013 LED Wall Pack
---- 2010 LED Wall Pack
---- Induction
---- 400W Metal Halide

WHAT IS NEW IN LED

WHAT IS NEW FOR COMMON SPACES

Fluorescent	Wattage	LED	Wattage	% of Savings
2 Lamp T8	58W	2GTL 4 40L	43W	26%
2 Lamp T8	58W	2GTL 4 48L	51W	12%
3 Lamp T8	88W	2GTL 4 60L	59W	33%
4 Lamp T8	112W	2GTL 4 72L	77W	31%

STANDARD LED TROFFERS HAVE DROPED IN PRICE FROM $600 IN 2010 TO $110 IN 2013 WHILE PERFORMANCE HAS INCREASED



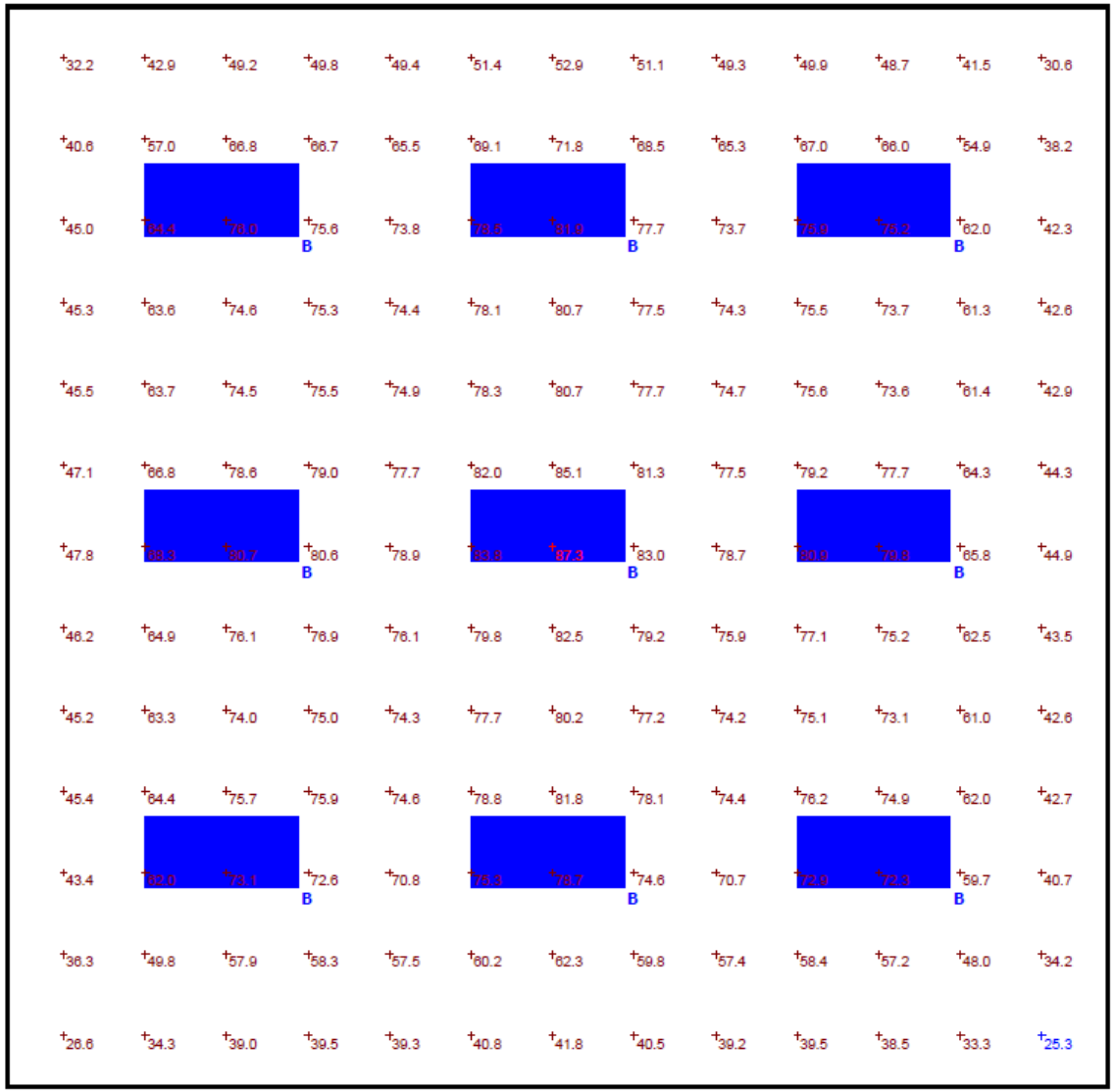
COMPARISON

2SP8 332 A12.125 MVOLT LP835	$103.60	1.1 W/SQ FT
2GTL 4800L LP835 NX	$149.50	.6 W/SQ FT

FIXTURES HAVE BEEN MARKED UP FOR APPROXIMATE DISTRIBUTOR AND CONTRACTOR MARK-UP.

FLUORESCENT FIXTURES HAVE PROGRAMMED START BALLASTS FOR COMPATIBILITY WITH OCCUPANCY SENSORS. THERE ARE TWO BALLASTS TO PROVIDE 50% REDUCTION OF LIGHT AND/OR 50% LIGHT FOR OCCUPANCY. NORMAL BALLAST FACTOR BALLASTS ARE USED. 80 CRI LAMPS WERE USED WITH 3500 DEGREE KELVIN TEMPERAATURE. NOTICE IN THE CALCULATION THAT THREE LAMP FIXTURES WERE REQUIRED TO MEET OR EXCEED 50 FC.

LED FIXTURES REQUIRED 4800 LUMEN LED ARRAY TO MEET OR EXCEED 50 FC. DIMMING IS STANDARD. LED LIFE IS NOT DECREASED BY SWITCHING WITH OCCUPANCY SENSORS.



Plan View
Scale - 1" = 4'

VISUAL

CLASSROOM FLUORESCENT
2SP8 332 A12 NORMAL BALLAST
FACTOR

Designer

Date
3/12/2014
Scale
Not to Scale
Drawing No.

Summary

Luminaire Schedule

Symbol	Label	Quantity	Manufacturer	Catalog Number	Description	Lamp	Number Lamps	Filename	Lumens Per Lamp	Light Loss Factor	Wattage
	B	9	Lithonia Lighting	2SP8 3 32 RA125	SPECIFICATION PREMIUM T8 TROFFER, 2'X4', WITH THREE LAMPS AND 0.125" THICK REVERSE APEX ACRYLIC LENS	THREE 32-WATT T8 LINEAR FLUORESCENT	3	2SP8_3_32_RA125.ies	2850	0.74	88

Luminaire Locations

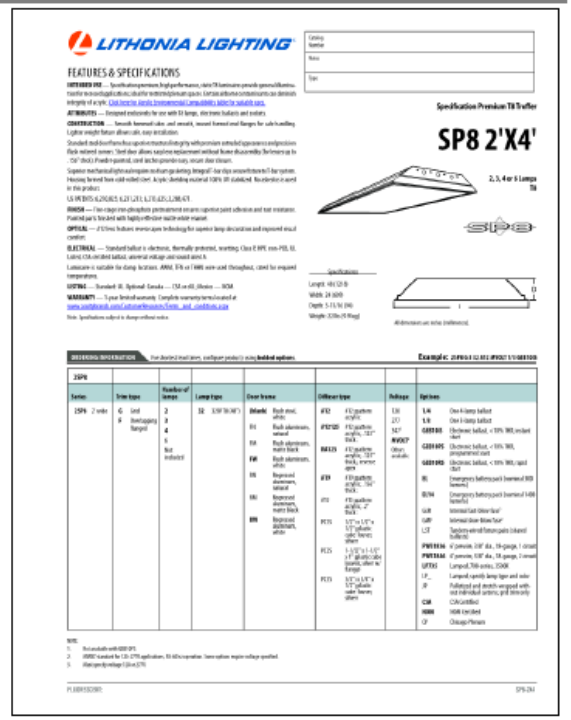
No.	Label	Location X	Location Y	Location Z	MH	Orientation	Tilt	Aim X	Aim Y	Aim Z
1	B	5.25	5.75	8.50	8.50	90.00	0.00	5.25	5.75	0.00
2	B	13.25	5.75	8.50	8.50	90.00	0.00	13.25	5.75	0.00
3	B	21.25	5.75	8.50	8.50	90.00	0.00	21.25	5.75	0.00
4	B	5.25	13.75	8.50	8.50	90.00	0.00	5.25	13.75	0.00
5	B	13.25	13.75	8.50	8.50	90.00	0.00	13.25	13.75	0.00
6	B	21.25	13.75	8.50	8.50	90.00	0.00	21.25	13.75	0.00
7	B	5.25	21.75	8.50	8.50	90.00	0.00	5.25	21.75	0.00
8	B	13.25	21.75	8.50	8.50	90.00	0.00	13.25	21.75	0.00
9	B	21.25	21.75	8.50	8.50	90.00	0.00	21.25	21.75	0.00

Power Statistics

Description	# Luminaires	Total Watts	Area	Density
Power Density Zone # 1	9	792.0 W	715.5 ft²	1.1 W/ft²

Statistics

Description	Symbol	Avg	Max	Min	Max/Min	Avg/Min	Avg/Max
WORKPLANE	+	63.6 fc	87.3 fc	25.3 fc	3.5:1	2.5:1	0.7:1


LITHONIA LIGHTING

FEATURES & SPECIFICATIONS

Specification Premium T8 Troffer

SP8 2'X4'

2, 3, 4 or 6 Lamps
T8

SP8

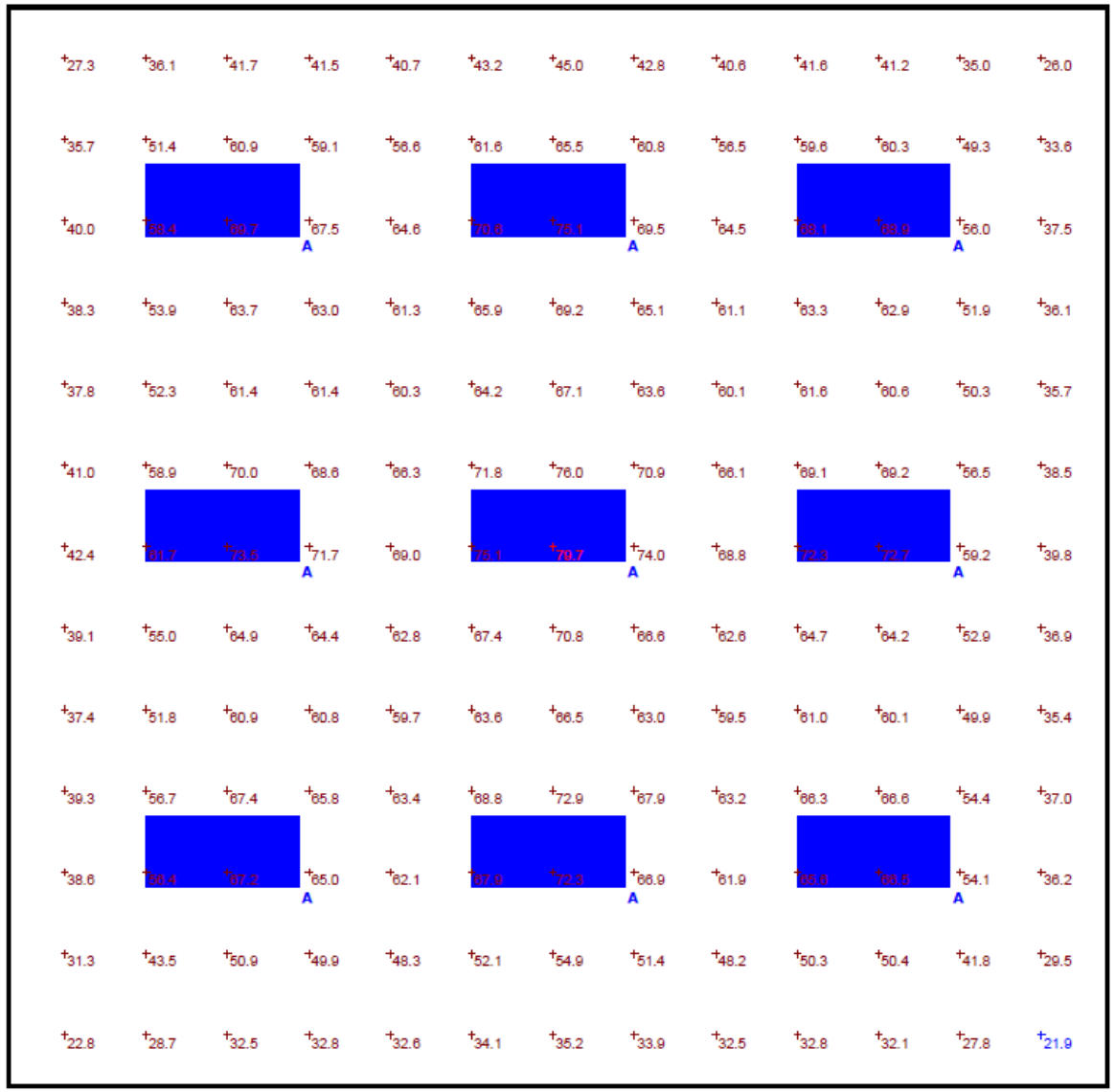
VISUAL

CLASSROOM FLUORESCENT
2SP8 332 A12 NORMAL BALLAST FACTOR

Designer

Date
3/12/2014
Scale
Not to Scale
Drawing No.

Summary



Plan View

Scale - 1" = 4'

VISUAL

CLASSROOM LED 4800L

Designer

Date
3/12/2014
Scale
Not to Scale
Drawing No.

Summary

Luminaire Schedule

Symbol	Label	Quantity	Manufacturer	Catalog Number	Description	Lamp	Number Lamps	Filename	Lumens Per Lamp	Light Loss Factor	Wattage
▯	A	9	Lithonia Lighting	2GTL 4 48L LP835	GENERAL PURPOSE LED TROFFER, 2'X4', WITH 4800 NOMINAL LUMENS, #A12 ACRYLIC LENS, AND 3500K LEDS	LED	1	2GTL_4_48L _LP835.ies	4836.882	0.9	51

Luminaire Locations

		Location						Aim		
No.	Label	X	Y	Z	MH	Orientation	Tilt	X	Y	Z
1	A	5.25	5.75	8.50	8.50	90.00	0.00	5.25	5.75	0.00
2	A	13.25	5.75	8.50	8.50	90.00	0.00	13.25	5.75	0.00
3	A	21.25	5.75	8.50	8.50	90.00	0.00	21.25	5.75	0.00
4	A	5.25	13.75	8.50	8.50	90.00	0.00	5.25	13.75	0.00
5	A	13.25	13.75	8.50	8.50	90.00	0.00	13.25	13.75	0.00
6	A	21.25	13.75	8.50	8.50	90.00	0.00	21.25	13.75	0.00
7	A	5.25	21.75	8.50	8.50	90.00	0.00	5.25	21.75	0.00
8	A	13.25	21.75	8.50	8.50	90.00	0.00	13.25	21.75	0.00
9	A	21.25	21.75	8.50	8.50	90.00	0.00	21.25	21.75	0.00

Power Statistics

Description	# Luminaires	Total Watts	Area	Density
Power Density Zone # 1	9	459.0 W	715.5 ft²	0.6 W/ft²

Statistics

Description	Symbol	Avg	Max	Min	Max/Min	Avg/Min	Avg/Max
WORKPLANE	+	54.9 fc	79.7 fc	21.9 fc	3.6:1	2.5:1	0.7:1

VISUAL

CLASSROOM LED 4800L

Designer

Date
3/12/2014
Scale
Not to Scale
Drawing No.

Summary

Result Summary Page

www.Visual-3D.com

Lithonia Lighting - 2SP8 3 32 A12125					
Energy Use kWh	18,831	Annual Op. Cost	$128	NPV	--
Energy Cost	$1,868	Annual Op. Savings	--	Life Cycle ROI	--
Initial Cost	$1,513	Simple Payback (yrs)	--	IRR	--
Lithonia Lighting - 2GTL 4 48L LP835					
Energy Use kWh	10,914	Annual Op. Cost	$69	NPV	$458
Energy Cost	$1,083	Annual Op. Savings	$59	Life Cycle ROI	23.6 %
Initial Cost	$1,939	Simple Payback (yrs)	7.43	IRR	10.6 %

Notes:

Annual Operating Cost and savings are based on an average year. Average year values are determined by averaging the future value cash flows throughout the life cycle.

Simple Payback is calculated using the actual future value annual cash flows, not the average annual operating savings shown above.

Net Present Value (NPV) prescribes a value in today's dollar of making a decision of one system over another. NPV sums the discounted annual cash flows over the life cycle of the system. This is the difference between life cycle costs

Internal Rate of Return (IRR) attempts to remove the uncertainty in the assumption of discount rate. The IRR is the 'annualized effective compounded return rate' or the rate of return that makes all cash flows equal to zero. IRR can not be calculated for some cash flows.

Life Cycle ROI is a percentage value that indicates the amount of money gained over the amount of money invested. In this tool ROI is calculated by comparing the life cycle cost of a system and its initial investment. This means the ROI includes the time value of money and is not an annual ROI but an ROI for the life cycle.

Assumptions

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Discount Rate & Energy

Discount Rate	0.0 %
Energy Rate	$0.08
Energy Increase Rate	3.0 %
Time Span	15 years

Maintenance

Weekday Hours	8	Install Labor Rate	$50.00	Ballast Service Rate	$30.00
Weekend Hours		Cleaning Labor Rate	$15.00	Lamp Replacement Rate	$25.00
Base Annual Hours	2,085.71				

HVAC

Cooling Hours Per Year	935
Cost Per Therm	$0.07
Heat Load Reduction	$2.00

Taxes

Local Sales Tax	3.0 %
Income Tax Rate	30.0 %
Write Off Life	10

Lithonia Lighting - 2SP8 3 32 A12125 [Baseline]

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Luminaire

Quantity	9	Luminaire Cost	$104
Manufacturer	Lithonia Lighting	Installation Cost	$50
Catalog	2SP8 3 32 A12125		
Total Wattage	88		
Number of Lamps	3		
Comment			

Result Summary

Energy Use kWh	18,831	Annual Op. Cost	$128	NPV	--
Energy Cost	$1,868	Annual Op. Savings	--	Life Cycle ROI	--
Initial Cost	$1,513	Simple Payback (yrs)	--	IRR	--

Lamp

Type	LinearFluorecent	Lamp Cost	$2.50
Life	30,000	Disposal Cost	$0.00
Lumens	2,850		
Comment			

Ballast

Type	Internal	Cost	$20.00
Qty	1	Disposal Cost	$0.00
Life	100,000		
Comment			

Maintenance

Relamping Strategy	Spot
Lamp Replacement	30 minutes
Ballast Replacement	60 minutes
Cleaning	10 minutes
Cleaning Cycle	36 months

Sustainability

Energy Use	18,831 kWh	Equivalent Annual Energy	1.13 homes
CO_2 From Energy	12.99 tons CO_2	Equivalent Annual Exhaust	2.54 cars

Lithonia Lighting - 2SP8 3 32 A12125 [Baseline]

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Occupancy Sensor Control

Type	Occupancy Sensor	Cost	$100.00
Weekday Hr Reduction	24.0 %	Installation Cost	$0.00
Weekend Hr Reduction	24.0 %		
Quantity	1		
Comment	Saves burn hours by turning off lights when occupants are not present. Frequent cycling may reduce lamp life depending on source.		

Lithonia Lighting - 2GTL 4 48L LP835

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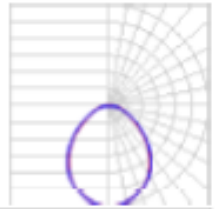
Luminaire

Quantity	9	Luminaire Cost	$150
Manufacturer	Lithonia Lighting	Installation Cost	$50
Catalog	2GTL 4 48L LP835		
Total Wattage	51		
Number of Lamps	1		
Comment			



Result Summary

Energy Use kWh	10,914	Annual Op. Cost	$69	NPV	$458
Energy Cost	$1,083	Annual Op. Savings	$59	Life Cycle ROI	23.6 %
Initial Cost	$1,939	Simple Payback (yrs)	7.43	IRR	10.6 %

Lamp

Type	LED	Lamp Cost	$50.00
Life	100,000	Disposal Cost	$0.00
Lumens	4,835.7		
Comment			

Ballast

Type	Integral	Cost	$35.00
Qty	1	Disposal Cost	$0.00
Life	100,000		
Comment			

Maintenance

Relamping Strategy	Spot
Lamp Replacement	30 minutes
Ballast Replacement	60 minutes
Cleaning	10 minutes
Cleaning Cycle	36 months

Sustainability

Energy Savings	7,918 kWh	Equivalent Reduction Trees Planted	140.14 seedlings
CO_2 Savings	5.46 tons CO_2	Equivalent Reduction Pine Forest	1.16 acres

Lithonia Lighting - 2GTL 4 48L LP835

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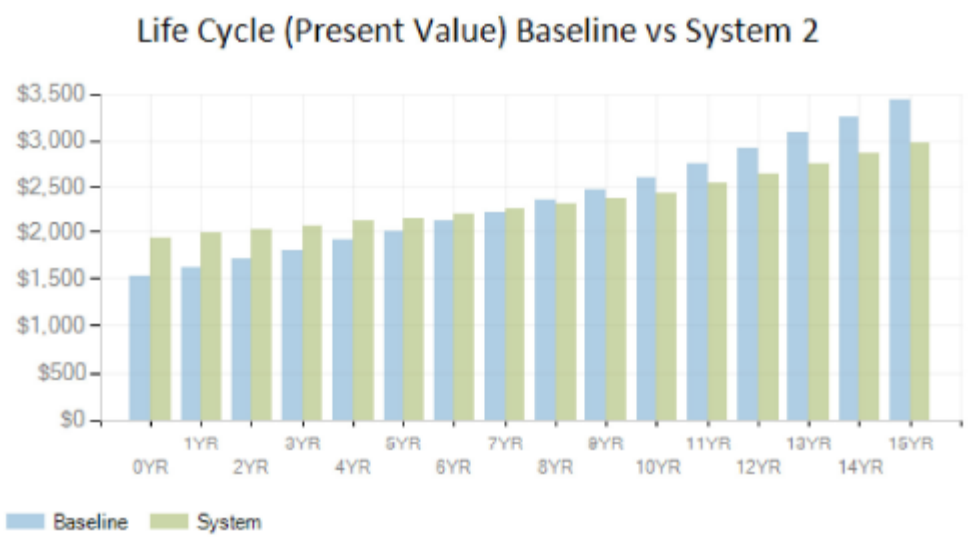

Life Cycle Cost	Baseline	System 2	Delta
Quantity	9	9	0
Luminaire Cost	$932	$1,346	$413
Control Cost	$100	$100	$0
Energy			
Burn Hours	23,777	23,777	0
Energy Cost	$1,868	$1,083	($785)
Energy Use kWh	18,831	10,914	-7,918
Operating Cost			
Ballast Cost	$43	$75	$32
Disposal Cost	$0	$0	$0
Lamp Cost	$53	$107	$53
Maintenance Labor	$266	$203	($62)
Taxes			
Initial Cost	$1,513	$1,939	$425
Income Tax Effect	($310)	($434)	($124)
Sales Tax	$34	$49	$15
Total	**$3,437**	**$2,979**	**($458)**

Lithonia Lighting - 2GTL 4 48L LP835

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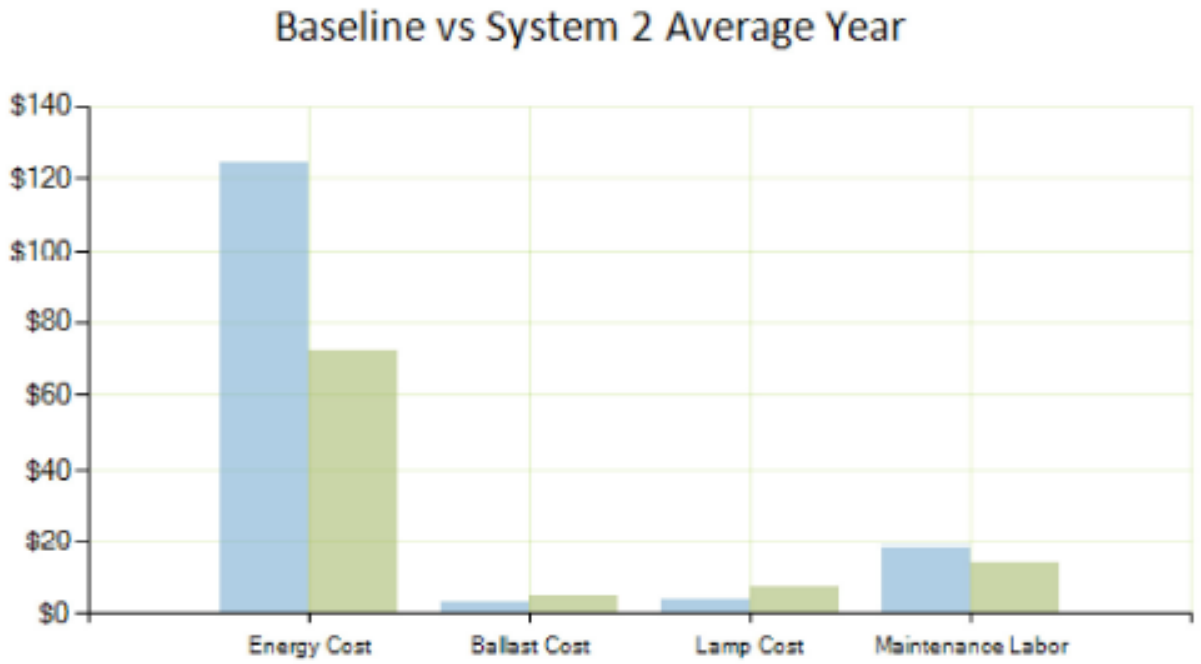
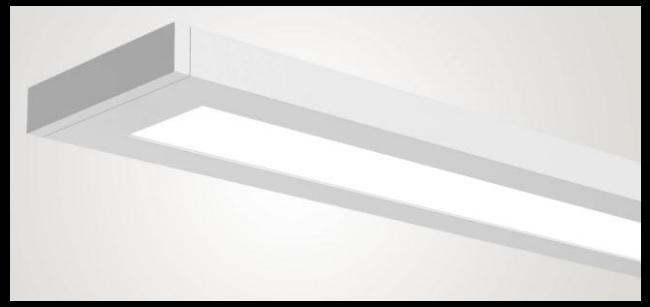
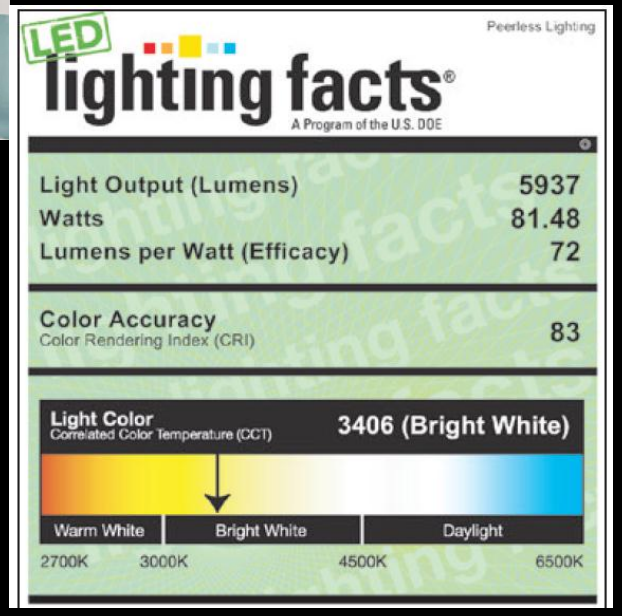
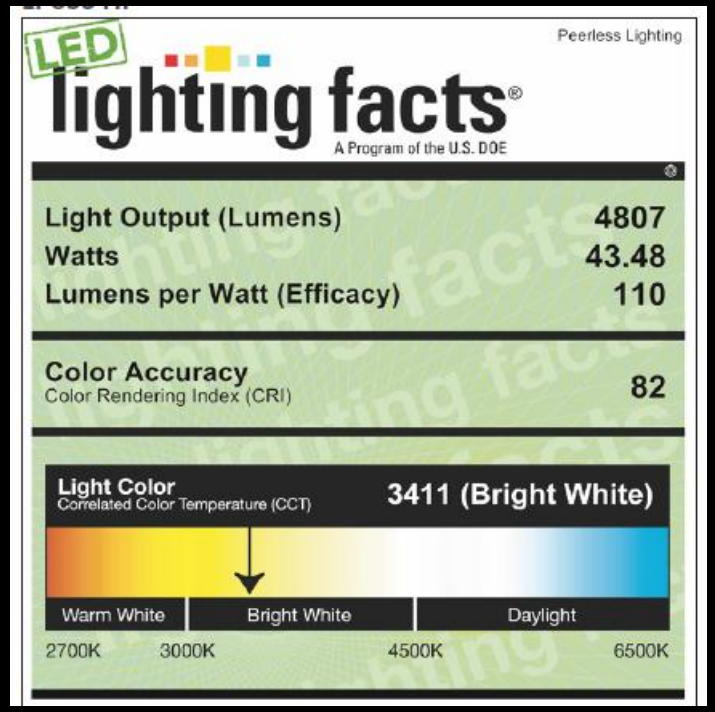


Average Annual Operating Cost Comparison	Baseline	System 2	Delta
Energy			
Burn Hours	1,585	1,585	0
Energy Cost	$125	$72	($52)
Energy Use kWh	1,255	728	-528
Operating Cost			
Ballast Changes	0.14	0.14	0.00
Ballast Cost	$3	$5	$2
Disposal Cost	$0	$0	$0
Lamp Changes	1.43	0.14	0.00
Lamp Cost	$4	$7	$4
Maintenance Labor	$18	$14	($4)
Total	**$128**	**$69**	**($59)**

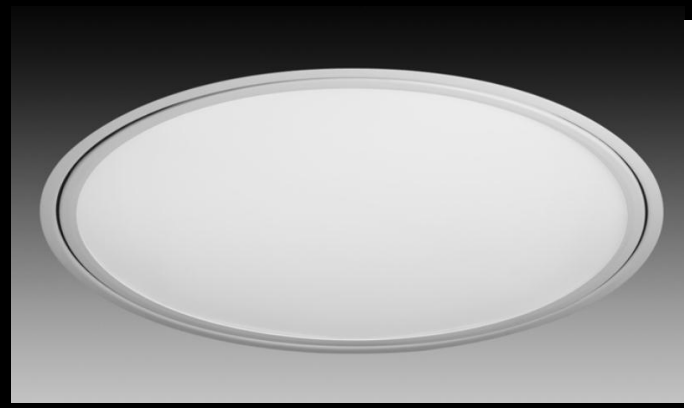
WHAT ABOUT THE CLASSROOM WITH HIGH CEILINGS…







WHAT ABOUT THE FEATURE AREAS…



LUMEN SUMMARY

	Zone	Lumens	% Fixt
	0°-30°	1455	30.0
	0°-40°	2325	47.9
	0°-60°	3956	81.5
	0°-90°	4858	100.0
Total Luminaire	0°-180°	4858	100.0

performance

Delivered Lumens: 3373lm
Total System Watts: 98W

performance

Standard Output
Delivered lumens: 2119lm
Tested system watts: 28.2W

Distribution	Delivered Lumens 5000K CCT	Delivered Lumens 4000K CCT	Wattage @ 120V	LPW @ 5000K
N	19,373	18,744	190	102
M	19,307	18,679	190	102
W	19,255	18,627	190	101
N	25,178	24,359	247	102
M	25,231	24,410	247	102
W	25,125	24,307	247	102

HIGHER AREAS…

Lumen Output Table*

CCT	Beam Angle 30°	Beam Angle 60°	Beam Angle 80°
5700K	20713 lm	20254 lm	19745 lm
4200K	18166 lm	17764 lm	17317 lm
3000K	15942 lm	15589 lm	15197 lm

Efficiency up to 86.3 LPW.

OPERATIONAL DATA

Lumen Package	Ambient Rating (120V - 277V)	Ambient Rating (347V / 480V)	Distribution	Delivered Lumens 5000K CCT @ 77°F (25°C) Ambient Temperature	Delivered Lumens 4000K CCT @ 77°F (25°C) Ambient Temperature	Lumen Multiplier @ 104°F (40°C) Ambient Temperature	Lumen Multiplier @ 104°F (40°C) Ambient w/SD125 Lens Kit
9L	-40°F to 131°F (-40°C to 55°C)	-40°F to 104°F (-40°C to 40°C)	WD	10,039	9,794	0.98	0.901
			ND	8,888	8,671	0.98	0.950
12L	-40°F to 131°F (-40°C to 55°C)	-40°F to 104°F (-40°C to 40°C)	WD	13,055	11,702	0.98	0.901
			ND	11,558	10,360	0.98	0.950
18L	-40°F to 131°F (-40°C to 55°C)	-40°F to 104°F (-40°C to 40°C)	WD	19,893	19,406	0.98	0.901
			ND	17,612	17,181	0.98	0.950
24L	-40°F to 131°F (-40°C to 55°C)	-40°F to 104°F (-40°C to 40°C)	WD	24,052	23,463	0.98	0.901
			ND	21,294	20,772	0.98	0.950
36L	-40°F to 131°F (-40°C to 55°C)	-40°F to 104°F (-40°C to 40°C)	WD	36,805	36,480	0.98	0.901
			ND	35,599	35,284	0.98	0.950
48L	-40°F to 131°F (-40°C to 55°C)	-40°F to 104°F (-40°C to 40°C)	WD	46,856	46,443	0.98	0.901
			ND	45,320	44,920	0.98	0.950

LOBBIES…

LED SOURCES REDUCE THE NEED TO DISMANTLE FIXTURES TO ACCESS LAMPS AND BALLASTS.

AUDITORIUMS

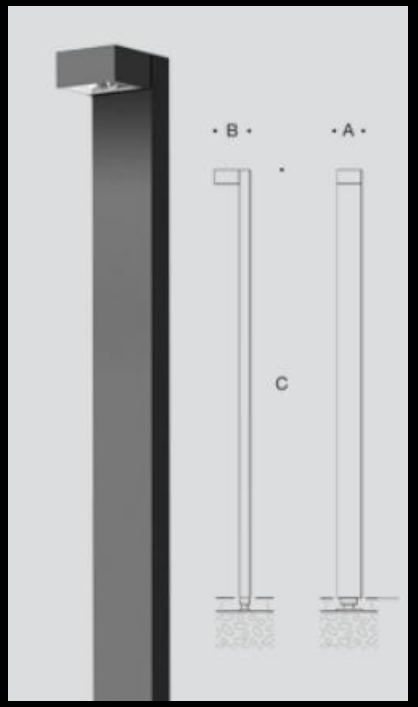
RETROFIT COMMERCIAL DOWNLIHGRS WITH HIGH LUMEN OUTPUTS

LED CYLINDERS AND DOWNLIGHTS WITH 6500 LUMENS OUTPUT AND JUST OVER 100 INPUT WATTS. REPLACES 500 T4 QUARTZ.

LED NOW IN THEARTICAL ALLOWING ADJUSTMENT USING POLES. REDUCES ELECTRICAL DISTRIBUTION COSTS.

OUTDOOR

LED SHOE BOXES HAVE INCREASED LUMEN OUTPUT TO 24,000 LUMENS WHILE PRICING HAS FALLEN BY OVER 50% TO AROUND $1000



SPORTS LIGHTING

98 Lumens per watt
50C Temperature Rating
L70 @ 50,000 Hours
5 Year Warranty
62,780 Delivered Lumens
640 Input Watts

QUESTIONS BEFORE DAYLIGHTING?

DAYLIGHTING SYSTEMS

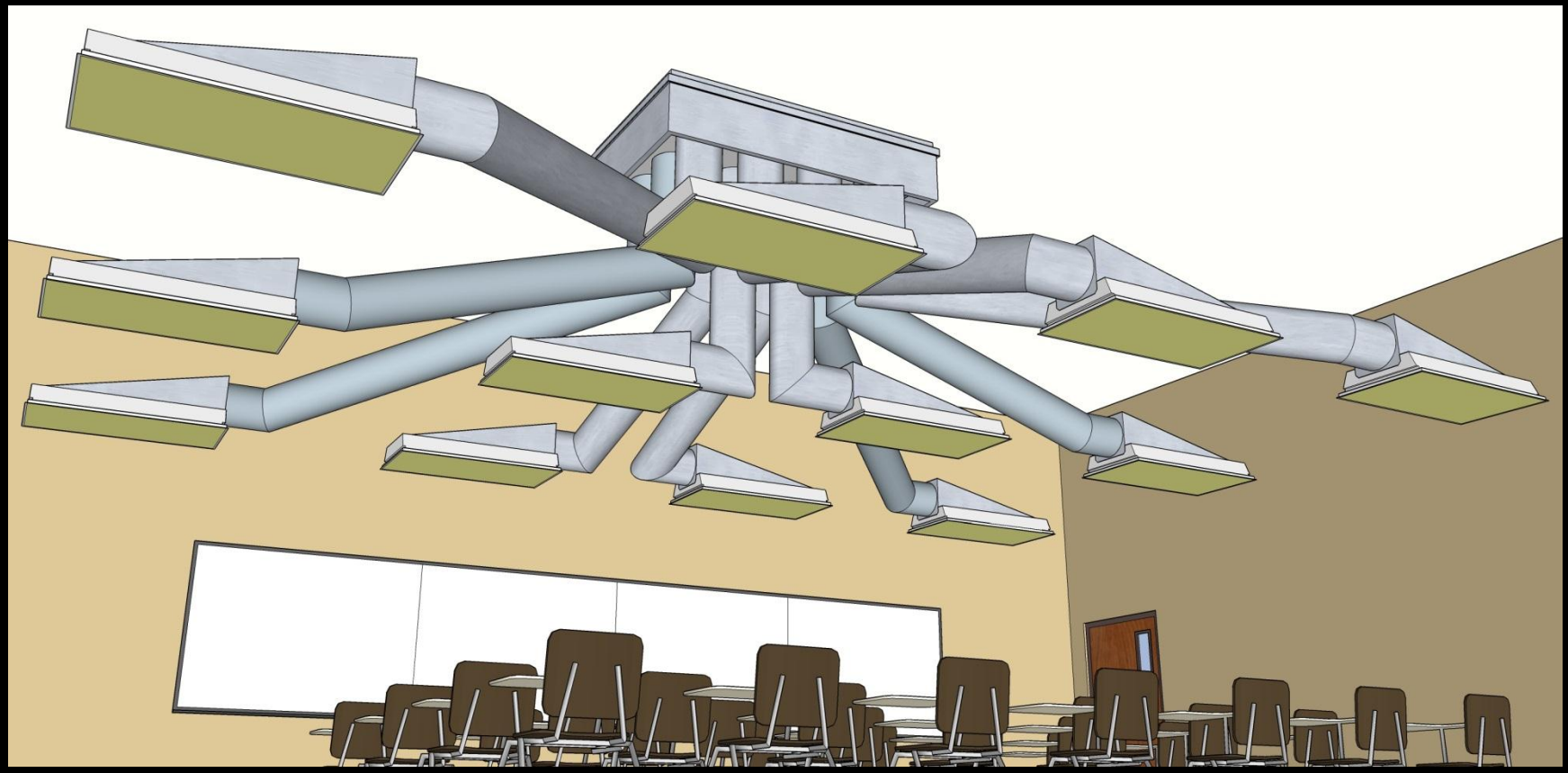
THE SYSTEM

- New and Innovative Skylight System designed specifically for schools which incorporates Natural Sun Light and Electric Light in Integrated Light fixture.
- Integrated Light Fixture provides continuously controlled light level regardless of time of day or weather conditions.
- System needs only 1 Roof penetration per typical sized classroom which reduces chances of roof leaks.

THE SYSTEM

- Dimmable Electric Light provided by either 2 T5 fluorescent lamps or 2 LED Strips.
- Integrated Shade system allows dimming of Sun Light from by fixture row.
- Lighting control system provides integrated control of lighting encompassing dimming, occupancy sensors and usage monitoring.

THE SYSTEM



THE SYSTEM

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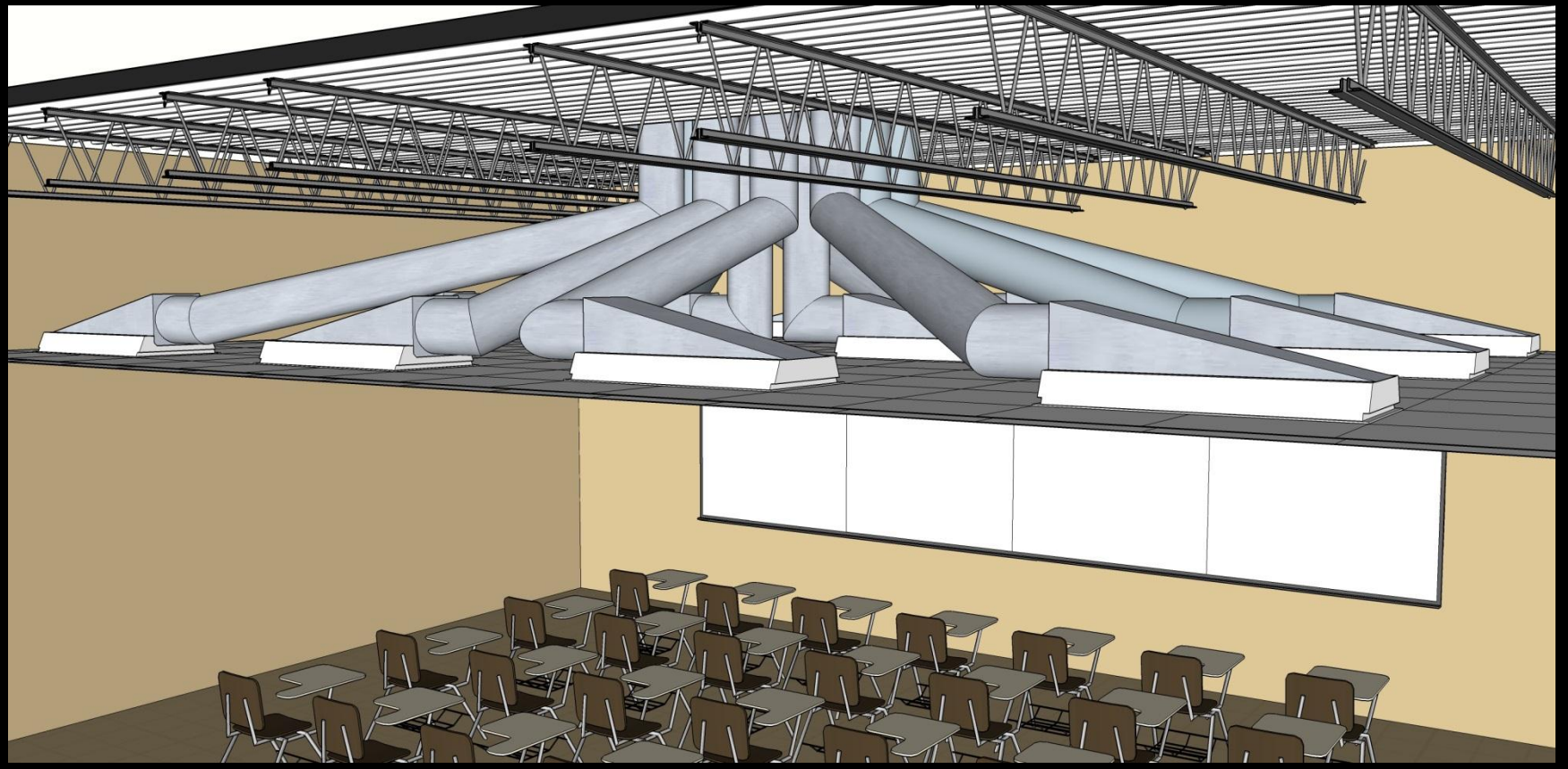

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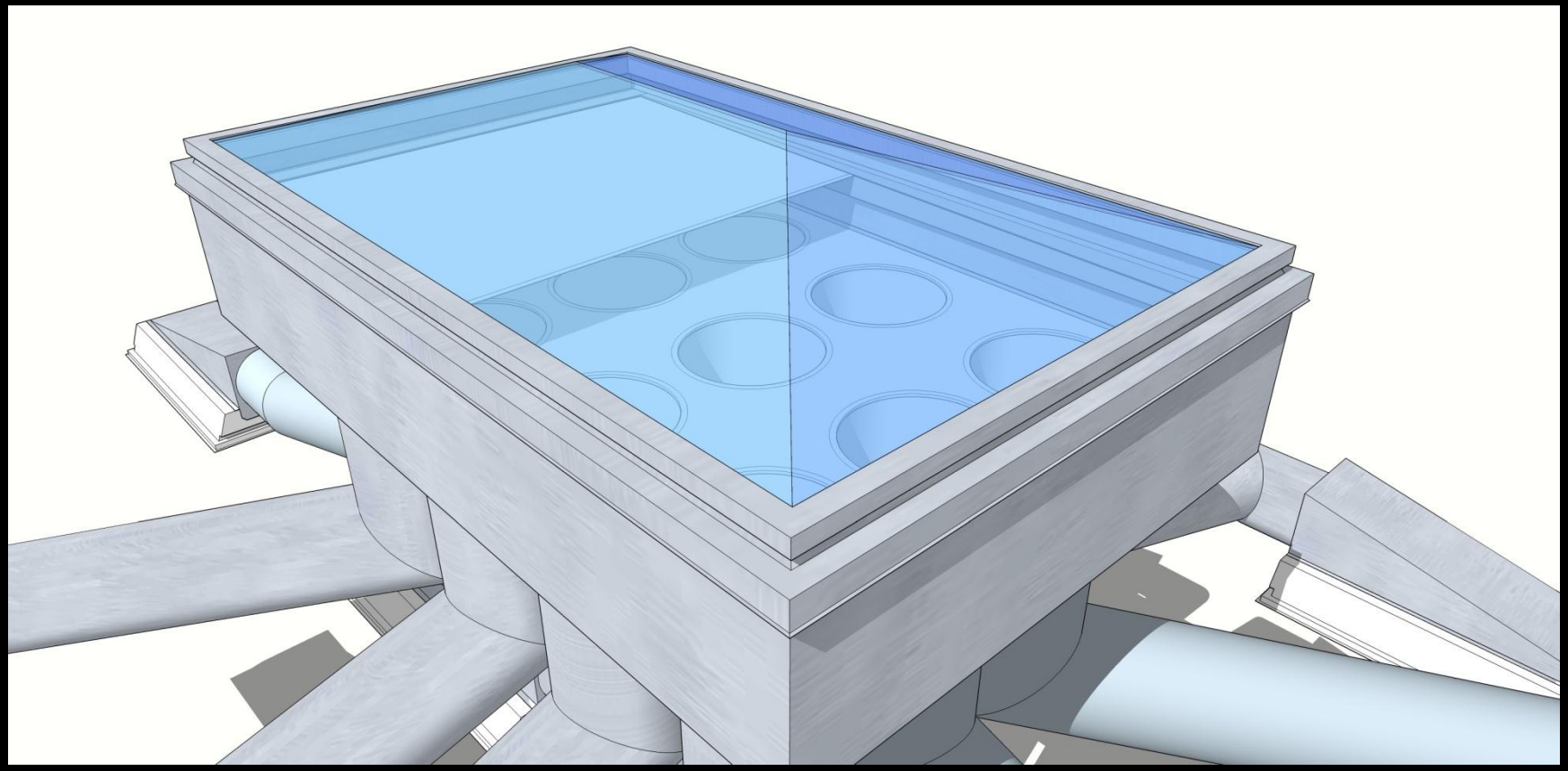

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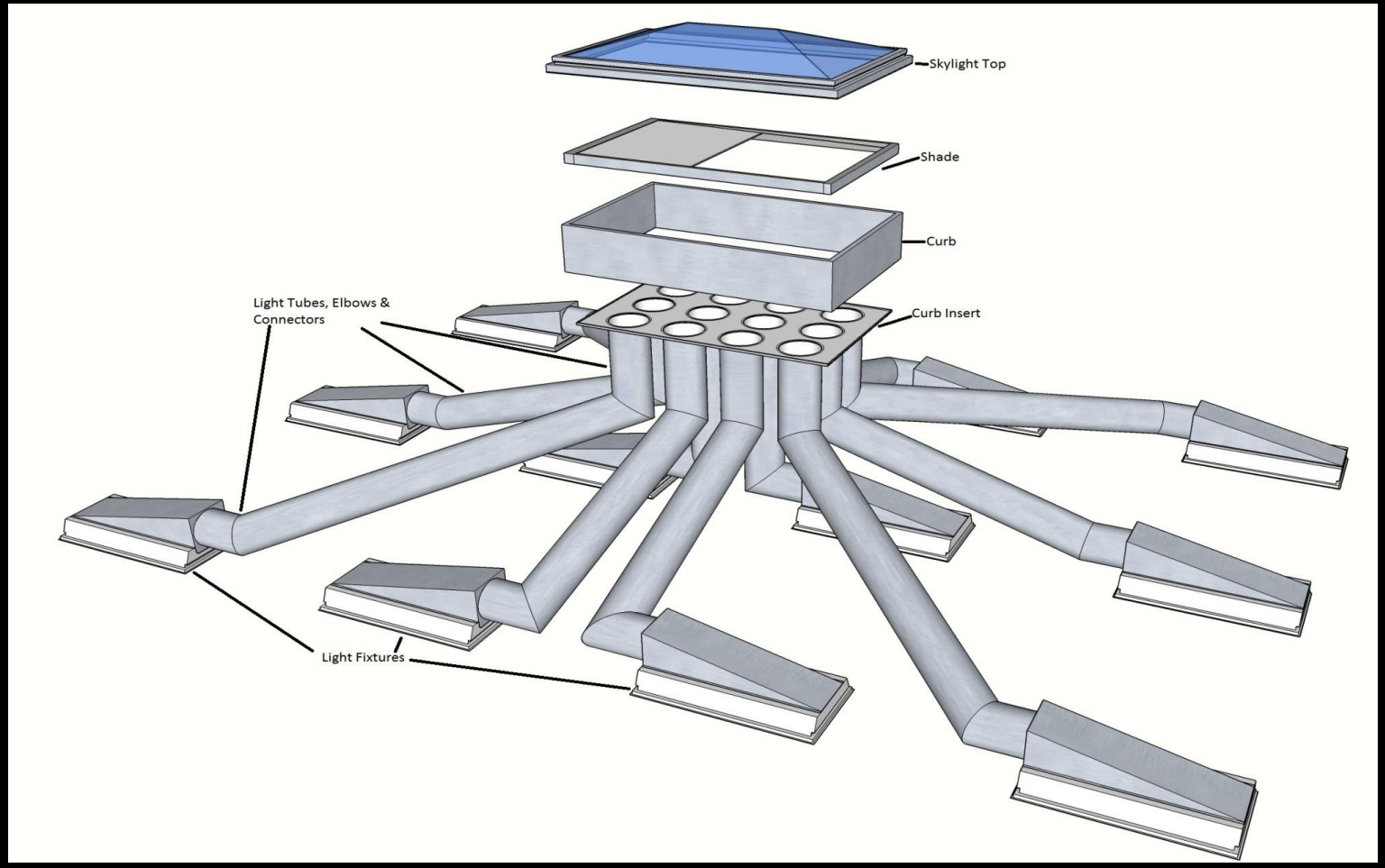
Skylight Top
Shade
Curb
Curb Insert
Light Tubes, Elbows & Connectors
Light Fixtures

THE SYSTEM INSTALLATION PICTURES

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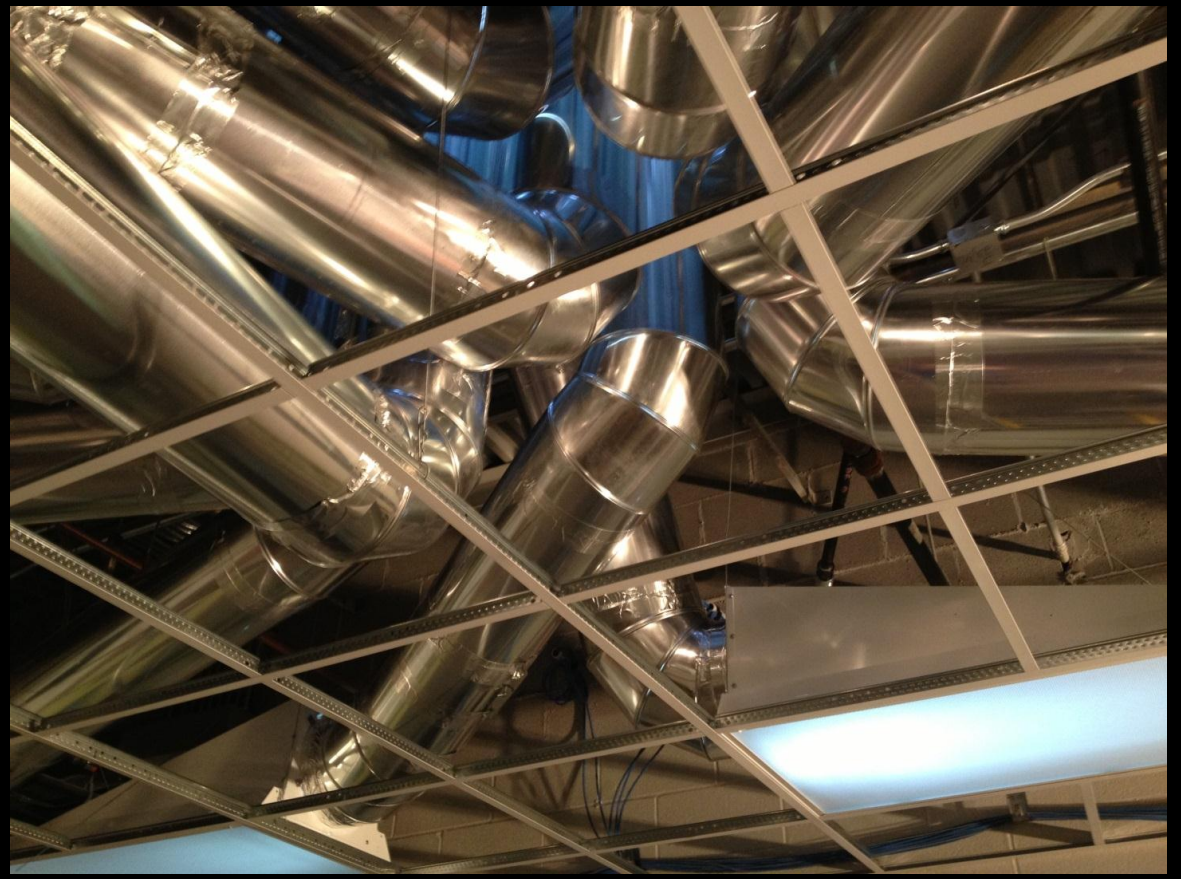


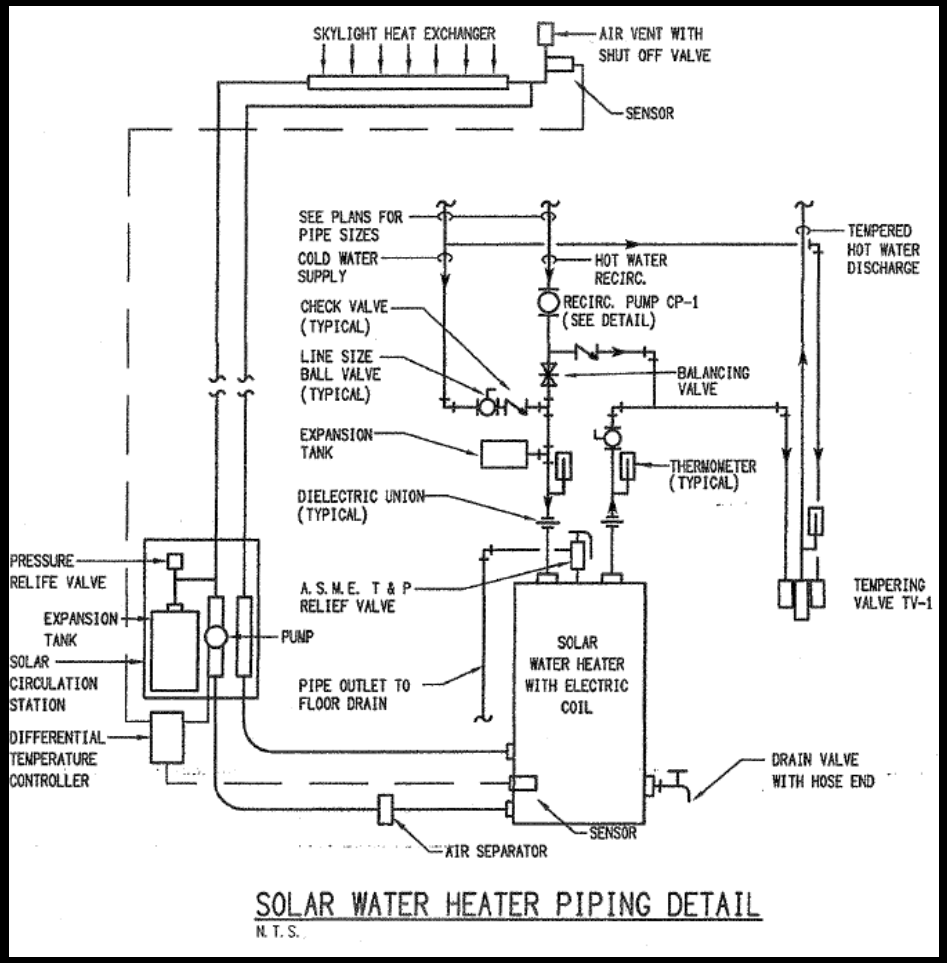
THE SYSTEM
COMPLETED ROOM PICTURES WITH ELECTRIC LIGHTS OFF

THE SYSTEM COMPLETED ROOM PICTURES WITH ELECTRIC LIGHTS OFF

THE SYSTEM COMPLETED ROOM PICTURES SHOWING PARTIALLY CLOSED SHADE

THE SYSTEM
COMPLETED ROOM PICTURES SHOWING FULLY CLOSED SHADE

NEW ADDITION….



DATA

- METERED DATA HAS BEEN GATHERED ON THREE ROOMS FOR APPROXIMATELY FOUR DAYS.
  - ROOM 1 – LIGHTS LEFT COMPLETELY OFF DUE TO SUFFICIENT DAYLIGHT 100% SAVINGS
  - ROOM 2 – DAYLIGHTING ENGAGED WITH LIGHTING DIMMED 75% SAVINGS
  - ROOM 3 – OCCUPANCE SENSING ONLY 33% SAVINGS